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A CRUISE WITH THE INTERNATIONAL ICE PATROL

By ROBERT DE C. WARD

[Harvard University, October 16, 1923]

The Titanic memorial service.—On April 15, 1923, the United States Coast Guard cutter *Modoc*, on Ice Patrol duty, took up her position at the exact spot where the *Titanic* sank, after collision with an iceberg, 11 years before.[1] A radio message from the *Modoc* had been sent to the Associated Press on the night of April 14, asking that churches should join in a memorial service at 10 a. m. (eastern standard time) on the following day. All ships at sea were asked to hold services at the same hour. All radios were silent for five minutes, between 10 and five minutes after 10. Under these circumstances, with many thousands of men and women and children, on land and on the high seas, uniting in commemorating the great tragedy, the service was held on the quarterdeck of the *Modoc*. The American flag was at half-mast. Full military honors were paid to the dead.

This incident was one of extraordinary human interest and significance. The *Titanic* sank, as other "missing" vessels undoubtedly sank before her, in the years gone by, through collision with an iceberg. The loss of the giant White Star liner was a catastrophe which should never occur again. The *Modoc*, on Ice Patrol duty, lying-to over the grave of the *Titanic*, is a symbol of a high resolve that everything possible shall hereafter be done to prevent any such disaster in the years to come. To-day the danger zone is patroled day and night during the ice season. All passing ships are given full information about the location of menacing bergs. Radio broadcast ice reports are sent out twice a day from the Ice Patrol vessel. Special reports can be requested, and are immediately furnished at any hour, day or night. Trans-Atlantic passengers may now pass through the danger zone with a feeling of safety which they never could have before the patrol was established. They may sleep peacefully, knowing that a United States Coast Guard cutter, on Ice Patrol service, is doing her duty not far away. No serious collision with ice has taken place in the area covered by the patrol since that service was inaugurated.

Establishment of the International Ice Patrol.—The *Titanic* disaster led to the establishment of the Ice Patrol. One month after that catastrophe, the United States Hydrographic Office (May 15, 1912) made a recommendation to the Navy Department that one or more naval vessels should patrol in the vicinity of the steamer lanes and warn passing ships of ice danger. Such a patrol was at once put into operation, the U. S. S. *Birmingham* and *Chester* alternating on this duty during the1912 ice season. In 1913 the United States Revenue Cutter Service (now the Coast Guard) took over the task, the cutters *Seneca* and *Miami* alternating in the service, while the British S. S. *Scotia*, well known as an Antarctic exploring ship, cooperated and completed a valuable series of meteorological and oceanographic observations. In the autumn of 1913 an International Conference for the Safety of Life at Sea was held in London, as one result of which 14 maritime nations agreed (January 20, 1914) to maintain a continuous patrol of the area of the North Atlantic most endangered by ice during the ice season. The United States Government was asked to undertake the management of this service, and each of the contracting powers agreed to assume a share of the expense in proportion to its shipping tonnage. Since 1914, with the exception of 1917 and 1918, during the war, the Ice Patrol has been maintained during each ice season by the United States Coast Guard.

The United States Coast Guard and the United States Hydrographic Office cooperate in the administration and operation of the patrol. The former furnishes the ships and the men, while the latter disseminates the information collected by the patrol vessels to shipping interests, and also controls the shifting of the steamship tracks. Administrative matters are vested in a board composed of the Commandant of the Coast Guard, the Hydrographer of the Navy, the Director of the Bureau of Standards, the Chief of the Weather Bureau, and a member of the Fisheries Board. Dr. Henry B. Bigelow, of Harvard University, is an honorary member and scientific adviser. The Commandant of the Coast Guard is president of this board.

The life history of the icebergs in the danger zone.—The essential facts regarding the ice which menaces North Atlantic steamship traffic may be briefly stated. Most of the bergs come from the fringe of glaciers bordering the west coast of Greenland, east of Baffin Bay, and represent the wastage from the Greenland ice cap. (See fig. 1.)

A few come from the east coast of Greenland, round Cape Farewell, and travel north as far as Davis Strait before turning south in the Labrador Current. Others doubtless start in the Smith Sound region and even farther north. One glacier in west Greenland is reported to "calve" on the average one iceberg a day, and this record is probably equaled in other cases also. Once icebergs are afloat, and free to move, they start to drift under the influence of the currents and winds. Many doubtless never leave their home latitudes. Others, after drifting to and fro, find their way into the cold current flowing southward through Davis Strait, known farther south as the Labrador Current. Some of these become stranded off the Labrador coast. Others ground

[1] The *Titanic* sank on Apr. 14, 1912, in latitude 41° 46′ N., longitude 50° 14′ W. Over 1,500 lives were lost.

For the illustrations accompanying this article the writer is indebted as follows: Figs. 4-6 and 8, to Lieut. Commander William J. Wheeler; Figs. 3, 9, and 10, to Lieut. E. H. Smith; Fig. 7, to Chief Radio Man W. W. Reynolds. Figs. 2 and 3 are from the *Pilot Chart of the North Atlantic Ocean* for March, 1923.

on the northern slope of the Great Bank. Others move westward along the southern coast of Newfoundland. Relatively few eventually travel eastward and then southward toward the Tail of the Bank; and it is these which constitute the greatest danger to trans-Atlantic steamers while following the most-used steamer lanes. Here the interplay of the cold Labrador water and the warmer Gulf Stream water, resulting in a more or less complex

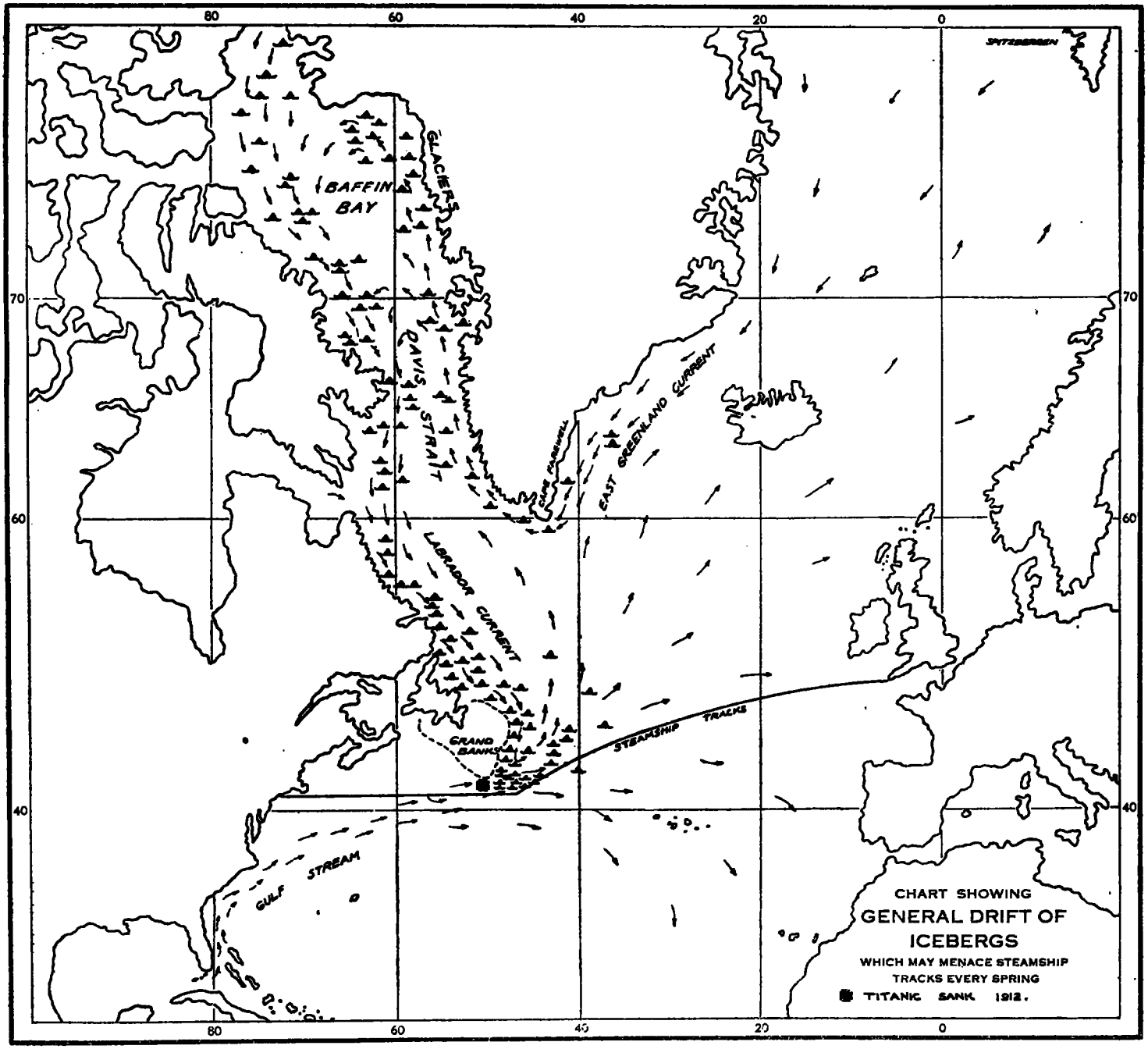

FIG. 1.—Map showing general drift of icebergs which may menace steamship tracks every spring

and varying series of eddies and currents, carries the bergs back and forth. Their courses, which often seem erratic, now appear, after careful study, to conform more or less to certain general rules. The typical drift of a large berg during the period from April 11 to May 12, 1921, is shown in Figure 2.

This berg was identified by means of photographs and in other ways; it was sighted four times during the month, and its track was carefully computed and plotted. The rate of drift of icebergs varies a good deal, a maximum of about 0.7 knot has been observed late in the season in the cold current around the Tail of the Bank. It has been estimated that if a berg keeps in the current, it will take it about five months to travel from Cape Dyer, Baffin Land, to south of latitude 45° N. Bergs do not long survive in the warm waters of the Gulf Stream, and they rarely drift more than a few miles south of its northern margin. Therefore the marginal region between the cold and the warm currents is the critical one for shipping, and it is the determination of the shifting boundary line between the safe and the unsafe areas which is one of the constant duties of the Ice Patrol. Hence the great importance of an accurate knowledge of the water temperature, in ascertaining which the

cooperation of all steamers in the danger zone is asked and expected. The dividing line between Labrador Current and Gulf Stream is often very sharply defined, not only by temperature, but also by the color of the water and by the "rips" which are seen, and felt, between the two currents. With the advance of summer, the iceberg-infested waters gradually become warmer; the Gulf drift of iceberg, April 21–May 12, fig. 2). Were the ice always in the same zone, the situation would be a simple one. The difficulty is that the number of bergs varies greatly from year to year, and that in some years they drift much farther southward than in others. It is on this account that the continued and regular work of the Ice Patrol is so important.

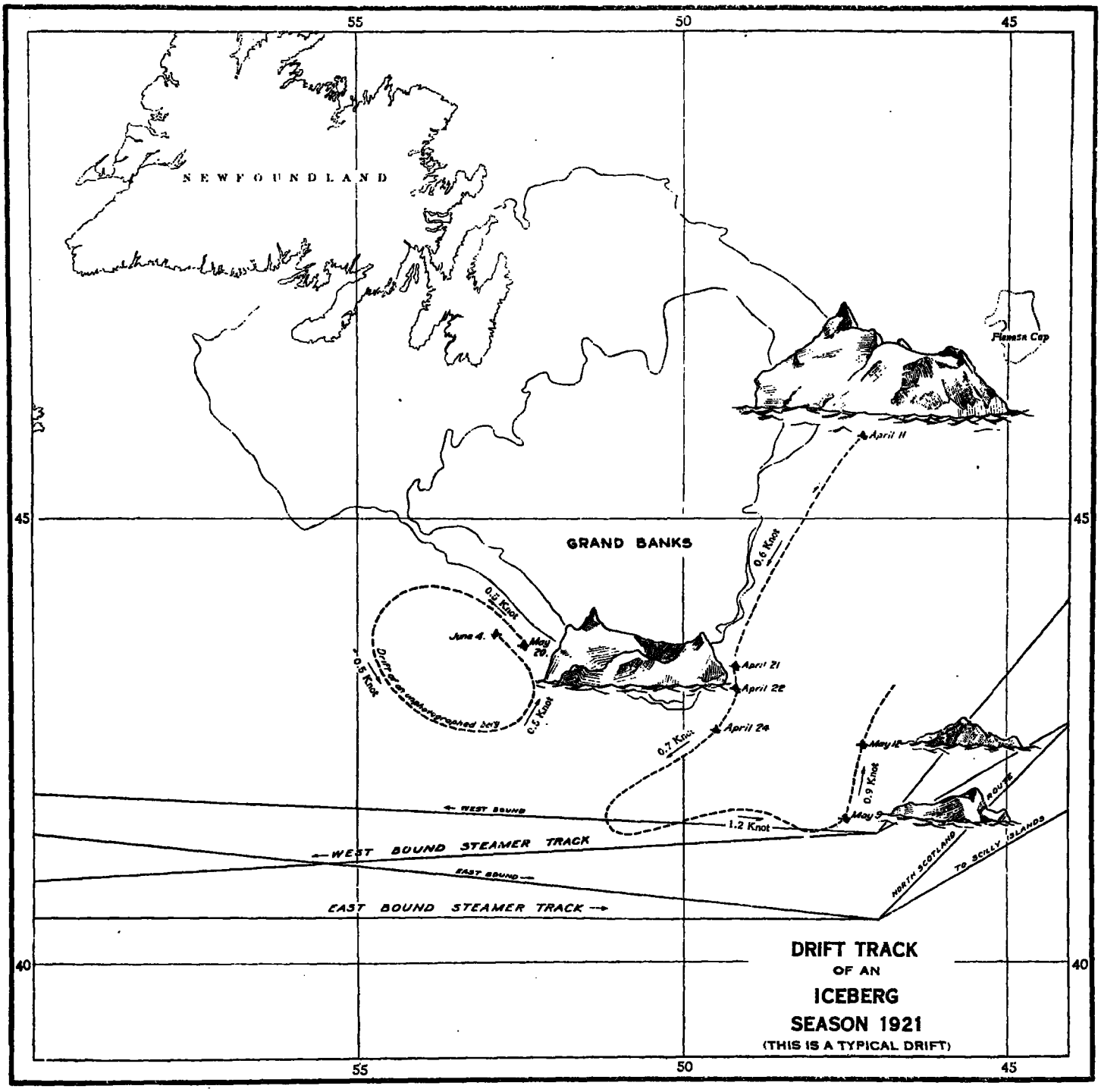

FIG. 2.—Map showing typical drift of an iceberg during the season of 1921

Stream moves northward to the Tail of the Bank, and the ice season reaches its end. The regular steamer tracks between Europe and the United States are located to the south of the southern end of the Labrador Current, where that current is turned backward and eastward by the Gulf Stream at the Tail of the Bank (note

Organization of the International Ice Patrol.—To carry on the Ice Patrol the United States Coast Guard details each year two of its newest and best-equipped cutters. During the past two years the *Modoc* and the *Tampa*, sister ships, have been assigned to this important duty. From March through June, and into July if necessary,

these vessels base on Halifax, N. S., where they obtain fuel and supplies. They alternate in cruising in the ice region, the period of duty being 15 days on actual patrol, exclusive of the time occupied in going to and from Halifax. When the 15 days have expired, the vessel on patrol is relieved by the sister ship at sea. The relieving ship brings out the mail, and receives on board the officer in charge of the scientific work of the patrol. This officer has, for the past five years, been Lieut. E. H. Smith. During the last two years, Lieutenant Smith has spent all of each ice season on the high seas, transferring from one cutter to the other at the end of each 15-day period. Under this plan, one man, who knows the locations and movements of all menacing icebergs and has prepared all the charts, is on duty continuously for about four months, with the resulting obvious advantage of a continuity of work and of responsibility. Lieutenant Smith's enthusiastic devotion to his task, which has deprived him of shore leave for about four months in succession during the past two ice seasons, has contributed very largely to the success of the Ice Patrol. He has, furthermore, been fortunate in securing most helpful cooperation from the commanding officers of the *Modoc* (Commander B. M. Chiswell) and the *Tampa* (Lieut. Commander W. J. Wheeler).

The United States Coast Guard Cutter "Tampa."—By invitation of Rear Admiral W. E. Reynolds, then commandant of the United States Coast Guard, the writer was given the privilege of taking part in the cruise of the *Tampa* on Ice Patrol duty from June 16 to July 2, 1923. On her outward trip the *Tampa* left Halifax June 14, and returned to port July 5, making a round trip of exactly three weeks.[1]

The *Tampa* was built at Oakland, Calif., in 1921. She is an electric drive oil burner of 1,600 tons, 240 feet long, and has a complement of somewhat less than 100 officers and men. She carries two 5-inch guns, one 3-inch gun, and two 6 pounders. She is named for an earlier Coast Guard cutter lost during the World War, a disaster appropriately commemorated by means of a bronze memorial tablet on the present *Tampa*. The earlier *Tampa*, having served as escort for a convoy from Gibraltar, was proceeding to Milford Haven, Wales, on September 26, 1918, after discharging her duty to the convoy. The night was very black. At 8:45 p. m. a loud explosion was heard, and before anyone could see what had occurred the *Tampa* was gone. A search by British and American destroyers and patrol vessels revealed some pieces of wreckage and the bodies of two men in naval uniform. Every man on the *Tampa*, 115 in all, perished. "Listening in" stations on shore reported that they had heard a submarine near the place where the *Tampa* sank, and the German submarine *U-53* later boasted that she had torpedoed an American vessel answering to the description of the *Tampa*. This was the greatest single disaster which befell any American vessel during the war.

It is a satisfaction to note here that Lieutenant Commander Wheeler, of the new *Tampa*, has a splendid war record. On two occasions, when in command of the United States Coast Guard Cutter *Seneca*, acting as escort to a convoy between Gibraltar and the English Channel, he went to the rescue of the men on board of a torpedoed ship, although it was then the established rule that if a vessel had been torpedoed other vessels near by should keep away and not run the risk of being themselves torpedoed. On one of these occasions (April 25, 1918), although the sinking British sloop *Cowslip* signaled "Stay away; submarine in sight, port quarter," Captain Wheeler approached the *Cowslip* three times, lowered his boats, and took off all the men who had not been killed by the explosion. For this he was commended by Admirals Sims and Niblack, by the British admiral at Gibraltar, and later by the British Admiralty. On the second occasion (June 28, 1918) the British steamship *Queen*, a member of the convoy, was torpedoed and sank in five minutes. As before, without a moment's hesitation, Captain Wheeler steamed to the sinking ship, firing his guns and dropping depth bombs, and rescued all the survivors. The Navy cross was later awarded to Captain Wheeler for his splendid services during the war.

General tactics and routine on an Ice Patrol cruise.—Hunting icebergs is the business of the Ice Patrol. More specifically, it is the duty of the Ice Patrol ship to determine the southern, eastern, and western limits of the ice, and to keep in touch with this ice as it may move into the vicinity of the regular trans-Atlantic steamship tracks. This duty involves a detailed search of the ocean area in the vicinity of the Tail of the Great Bank of Newfoundland, and therefore usually keeps the patrol vessel somewhat to the north of these tracks. Whenever the visibility is good, the Ice Patrol ship combs the critical areas, steaming on a rectangular, triangular, or zigzag course, keeping careful lookout for ice, both from bridge and crow's nest. When a berg is discovered, the course is changed so as to bring the ship near it. The berg is then examined at close range and sketched or photographed so that it may later be identified. Its position is also plotted on the chart. In thick weather, and especially in fog, searching is out of the question. The patrol ship therefore usually drifts, or, if she is on the Great Bank, anchors until the search can be renewed. "Drifting" is often done in fairly close proximity to an iceberg, in order that the rate and direction of its movement may be studied. On her May cruise, the *Tampa* kept her searchlight playing on an iceberg during a dark and stormy night in order that the berg might not be lost sight of. If there happens to be much fog, a good deal of a 15-day cruise may be spent drifting or at anchor. The experience is a novel one to the ordinary trans-Atlantic traveler who is accustomed to steaming ahead all the time, regardless of fog. The June, 1923, cruise of the *Tampa* came in a foggy time, and therefore there was less steaming and searching for ice, and more drifting and lying at anchor, than is usual earlier in the season. The accompanying Figure 3, prepared by Lieut. E. H. Smith, shows the successive noon positions of the ship from June 7 to July 2, but does not attempt to give the very numerous varied courses which she followed during those days. It also shows the positions of the icebergs seen by or reported to the Ice Patrol cutter during that time.

Even when lying still, the Ice Patrol ship is a busy place. She is the clearing house for all information about ice. Every vessel passing through the ice region (between long. 43° and 55° W.) is expected to send by radio to the patrol vessel exact information as to any ice sighted, as well as four-hourly reports of water temperatures, and other data. As each vessel enters this area, her successive positions are plotted on board the patrol ship, so that her course may be followed stage by stage during her progress. If any passing steamer is seen to be in danger, a message is sent to her, informing

[1] The writer is under great obligations to the commanding officer of the *Tampa*, Lieut Commander William J. Wheeler, for unfailing courtesy and thoughtful attention throughout the cruise; to Lieut. E. H. Smith for most helpful interest and cooperation, and to the other officers of the ship for many favors.

her of the location of any neighboring berg, and advising a change of course. When a report comes in to the patrol ship of an iceberg not previously seen and charted, and in a dangerous position, a broadcast is at once sent out so that all vessels may be warned. At the same time the patrol ship immediately steams to the reported position of the new berg. Thus, on the *Tampa*, on two occasions during the June cruise such reports of ice led to the vessel's steaming a distance of 50 to 75 miles in order to investigate, and on one of these occasions the trip was made through dense fog. Again, inquiries often come in asking whether a certain vessel, following a certain course, is likely to meet ice. To all such questions immediate and full replies are sent. It not infrequently happens that vessels reporting ice give a position for the berg which is many miles out of the way, or even report a berg which careful search fails to reveal at all, and which may have been a distant cloud. Such wild-goose chases are well known on Ice Patrol duty.

In addition to the very numerous individual messages sent to passing ships, several regular broadcasts are sent out each day. Twice daily, at 6 a. m. and 6 p. m. (75th meridian time) a broadcast is sent to all vessels, giving full information regarding the position of all dangerous ice. Once a day, at 7 p. m. (75th meridian time), a message is sent to the Hydrographic Office in Washington

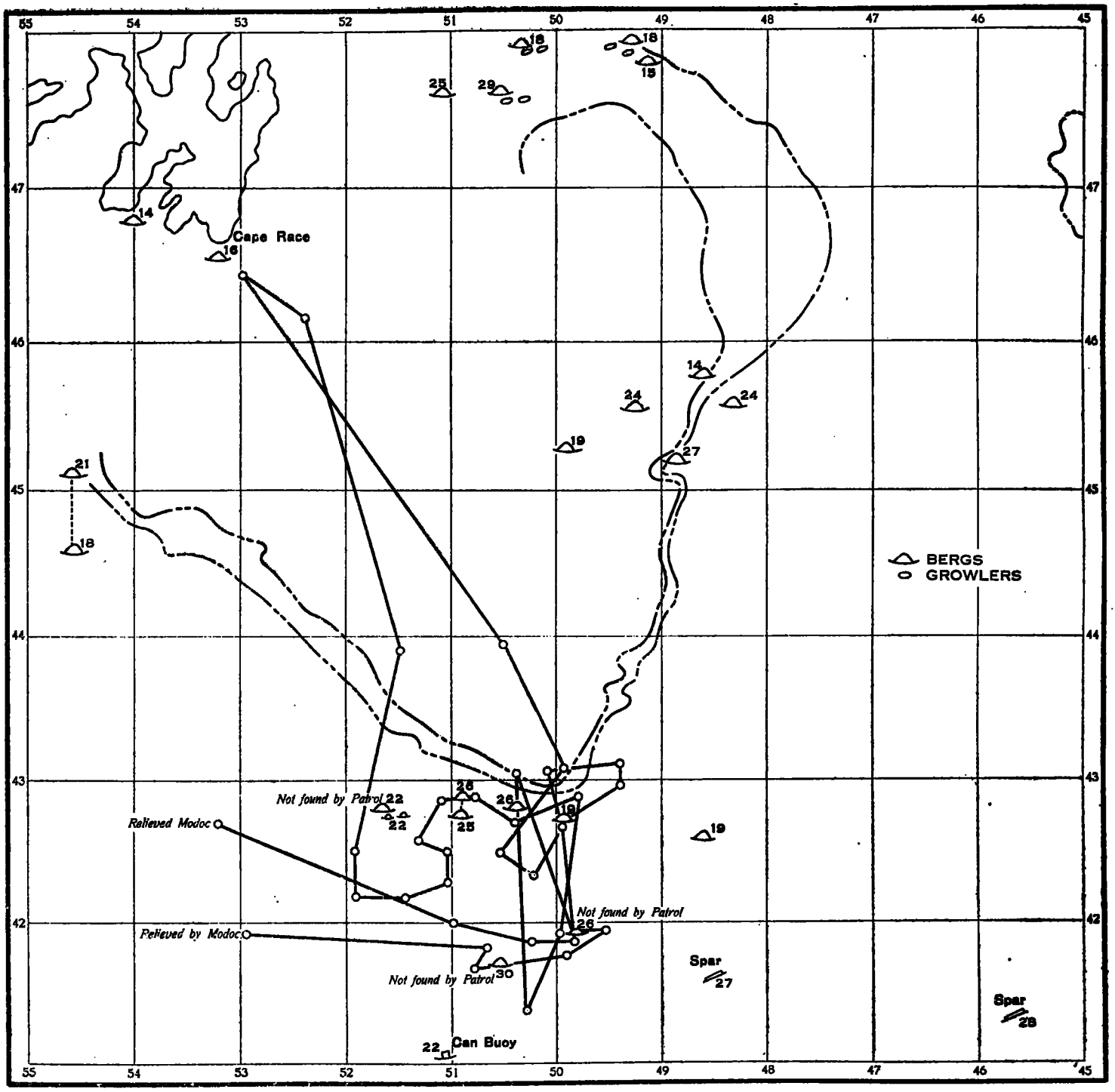

FIG. 3.—Noon positions and iceberg chart for the June, 1923, cruise of the *Tampa*

giving all essential facts as to ice and defining the ice danger zone.[8] Twice daily, at 7 a. m. and 7 p. m. (75th meridian time), a message is sent to the Weather Bureau in Washington, covering the regular meteorological observations. Without radio-telegraphy the Ice Patrol would be impossible. There are few busier places than the radio room on an Ice Patrol ship, and few places where more effective work is done toward saving human life.

Oceanographic stations.—At various times during the Ice Patrol season, as opportunity offers, observations of deep-sea temperatures and salinities are made at a series of oceanographic stations arranged along five lines radiating from a central point on the southern part of the Great Bank. The observations thus collected during the past few years by the Ice Patrol furnish the most complete body of data available for the study of the ocean currents of this part of the North Atlantic. On the June, 1923, cruise of the *Tampa*, as no ice duty farther south was immediately pressing, a series of such observations was made along a line of stations extending north across the central part of the Great Bank toward Cape Race. This portion of the cruise took the vessel into the highest latitudes reached during the 15 days. The northernmost position was within about 25 miles of Cape Race, N. F. It was during this northern trip that a severe northeast gale, later referred to, was encountered.

Steamer tracks.—The ice conditions found by the Ice Patrol are the determining factor in fixing the location of the trans-Atlantic steamer tracks. These tracks are moved extra far to the south, even south of the usual summer tracks, when the ice is especially far to the south and east of the Bank, thus lengthening the course but contributing very greatly to safety. Toward the end of June, a radio message reached the *Tampa* from Washington, asking whether the Ice Patrol would advise or recommend having the tracks shifted northward on July 1. The decision was clearly one involving a heavy responsibility on the part of the commanding officer of the *Tampa* and of the officer in charge of the scientific work. In view of the recent report of an iceberg not far from the steamer tracks, the reply was sent that a delay in shifting the tracks was considered advisable. In this connection mention may be made of a novel method of decreasing danger from ice which was tried during May, 1923, cruise of the *Tampa*. Guncotton wrecking mines were used on four successive days in order to shorten the life of a berg which had drifted dangerously near the steamship lanes. The berg was already softened by being in warm air and warm water, but it is believed that its end as a danger to navigation was hastened by fully two days as the result of the explosions. Figure 4 is a photograph of this berg while a mine was being exploded, and Figure 5 shows the result of the explosion.

The use of wrecking mines for the purpose of destroying icebergs is not feasible or practicable under ordinary circumstances. In the case here referred to, the berg was already in a stage of disintegration. It should be remembered that a large berg, in cold water, contains many thousands of tons of hard ice. A berg 65 feet high and 1,690 feet long, seen by the *Tampa*, was calculated to contain approximately 36,000,000 tons of ice. The destruction of such a mass is obviously quite beyond human power, especially under the conditions obtaining at sea.

Some typical icebergs.—Through the kindness of Lieut. Commander William J. Wheeler, commanding officer of the *Tampa*, and of Lieut. E. H. Smith, it is possible to include several views of icebergs taken during recent cruises of that vessel.

The size of icebergs is usually greatly overestimated. The Ice Patrol often receives reports of bergs stated to be 300 to 400 feet high, and half a mile long. During four years past, of the two largest bergs observed, one was 248 feet above the water at its highest point, and the other was 1,690 feet from end to end. These were accurate measurements, made with a sextant.

Meteorological observations.—A fairly complete meteorological log was kept by the writer throughout the June cruise. The pressures were conveniently recorded on the writer's small-size self-recording barometer, an instrument which successfully continued an almost uninterrupted service of over 25 years. This instrument, as on previous voyages, was suspended from the ceiling of the stateroom at the end of a spiral spring, and was prevented from excessive swinging by means of strings carried laterally to near-by stanchions. Water-surface temperatures and night observations were taken from the ship's log.

June is characteristically a fine weather month over the North Atlantic, with summer conditions well established, a minimum of weather changes, weak to moderate barometric gradients, and gales occurring only 5 to 7 per cent of the time over the stormiest portion of the northern steamship lanes. June and July are the months of most fog, the maximum percentage of "days with fog" according to the June *Pilot Chart of the North Atlantic Ocean* being 60 to 65 per cent over a considerable area east and northeast of Newfoundland. The general run of the weather was, with one exception, what was to be expected in the first summer month. Moderately high and uniform pressure prevailed most of the time, with light variable winds, about equally proportioned between those from northerly and those from southerly points. There was little rain, and that in a few brief showers. There were many dull and overcast, and one or two bright sunny days. The sea was mostly smooth to moderate. Owing to the fact that her duty requires the Ice Patrol ship to spend most of her time north of the steamer lanes, in the cold water of the Labrador Current, temperatures, both of air and water, were low, being between 40° and 50° F. during most of the time. It was not until the last few days, at the northern edge of the Gulf Stream, and with SW. winds, that higher temperatures were recorded. The maximum was 67°, on the last day of the patrol, and the minimum 38.° The daily range averaged under 10°; on several days it was less than 5°. The maximum and minimum water surface temperatures were 62° at the edge of the Gulf Stream, and 38° in the Labrador water. When the *Tampa* on two or three occasions crossed into the Gulf Stream water there was a sudden rise in temperature of 5° to 10°, and a short spell of rough water.

Fog was the dominant feature. On the basis of hourly observations fog of varying degrees of density prevailed nearly 70 per cent of the time, an average somewhat above that shown on the Pilot Chart for the same area (about 50 per cent). The fogs of the Bank are generally known to be most prevalent with light to gentle southerly (S., SE., SW.) winds, when warm moist air from the Gulf Stream drift is carried across the cold Labrador water. The conditions on the present cruise

[8] A sample of such a report is the following: "Our position, lat. 40° 33′, long. 48° 20′; three bergs within radius of 5 miles. Fog shrouds them at times; very dangerous to westbound traffic. A few bergs along east side of Great Bank and around tail. One berg, lat. 42° 52′, long, 49° 51′; one berg, lat. 42° 42′, long 49° 42′; one berg, lat. 48° 07′ long. 45° 55′. Many bergs between Flemish Cap and Great Bank. Fifty growlers northeast of Cape Race."

(To face p. 76.)

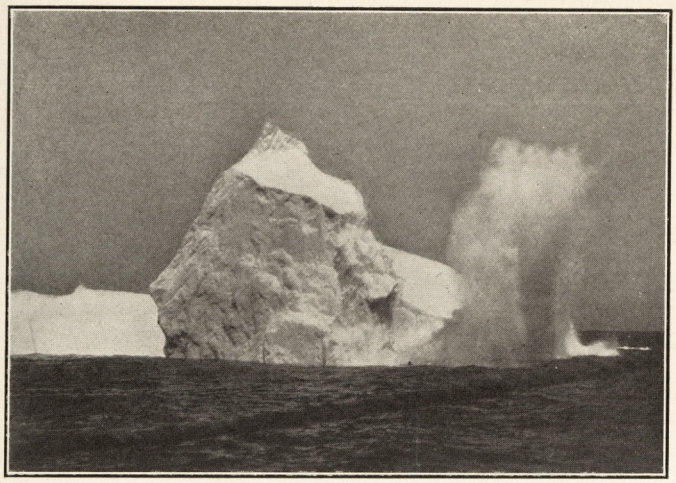

FIG. 4.—Shortening the life of an iceberg by means of a wrecking mine

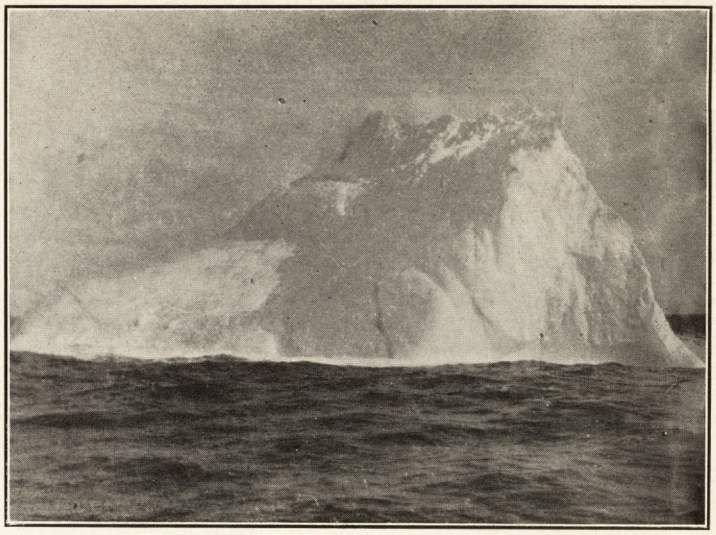

FIG. 7.—A massive iceberg, waterworn near the surface

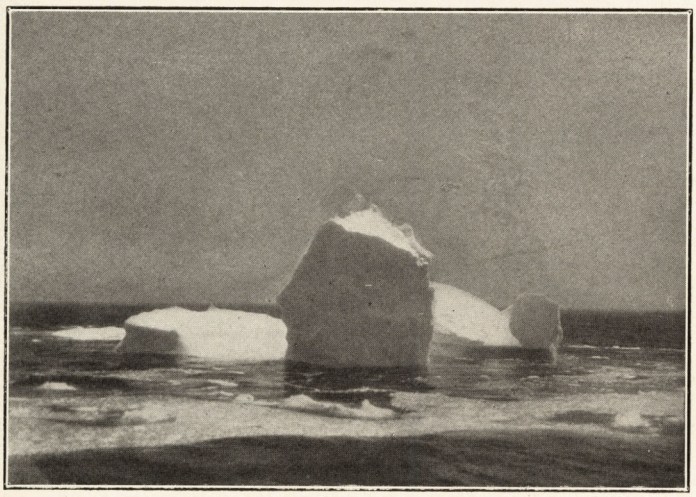

FIG. 5.—The result of explosions in breaking up an iceberg

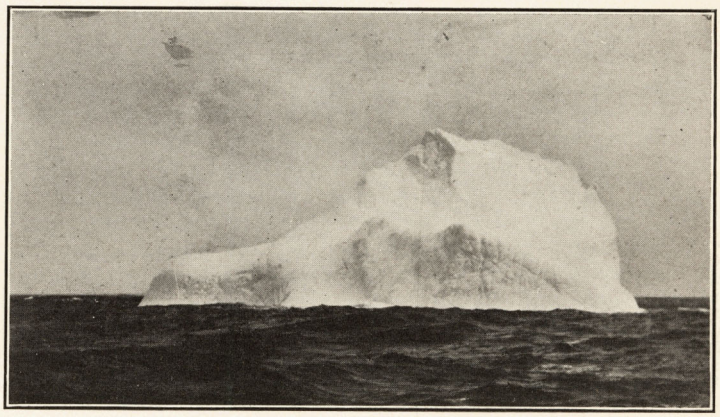

FIG. 8.—A berg well smoothed by wave action and by melting

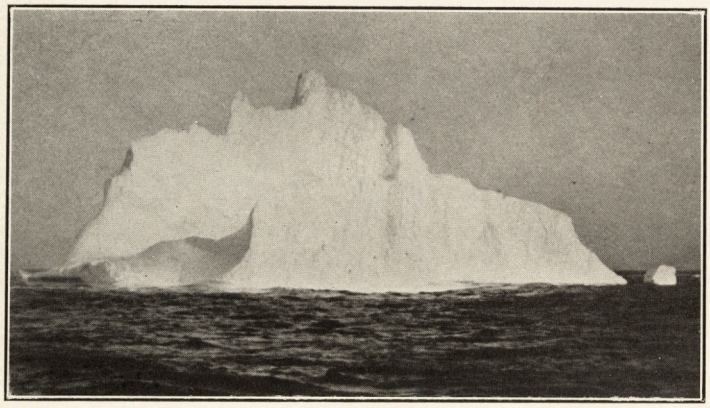

FIG. 6.—Iceberg with two vertical faces and a small "growler"

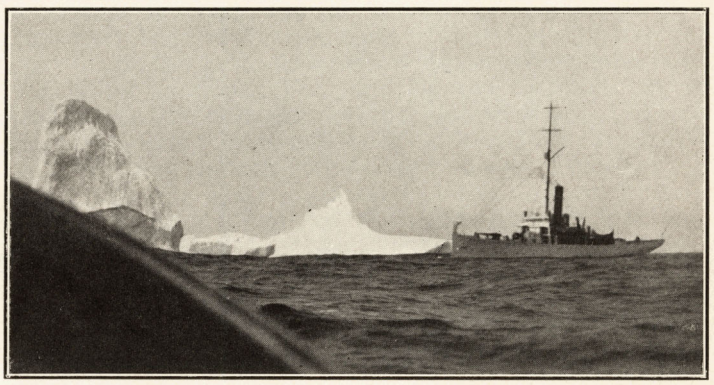

FIG. 9.—The *Tampa* lying close to a small berg

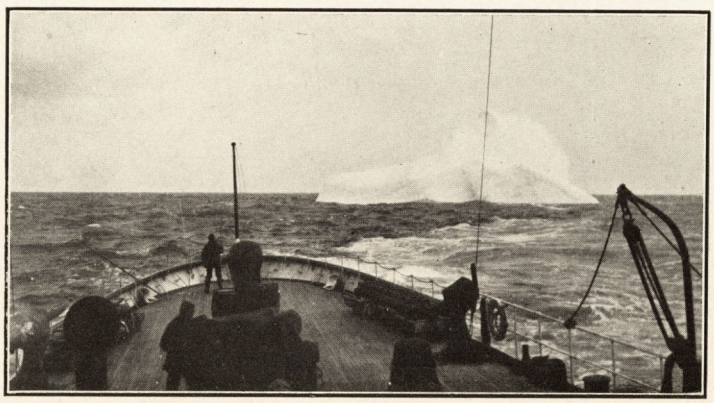

FIG. 10.—A small berg, well waterworn and melted, looking aft on the *Tampa*

were in agreement with this fact, but considerable fog also occurred with NE., N., and NW. breezes. The question arises whether northerly winds are not more likely to be foggy in summer, when they are warmest, rather than during the colder months.

In order to study the vertical distribution of temperature in fogs, several sets of simultaneous observations were secured on the lower deck and in the "crow's nest," about 12 feet and 90 feet above the water line, respectively. These observations were made when the wind was southerly in the morning and also about sunset, during dense fogs which extended vertically above the "crow's nest." The temperatures at 90 feet were 4° to 5.5° higher than those on the deck, the surface water being 4° to 15° colder than the air 12 feet above it. Inversions averaging about 5° in 78 feet were thus found, or about 1° in 15 feet. The marked chilling of the air in close contact with the cold water is clearly seen in these observations.

An interesting phenomenon was observed on a late afternoon near the northern margin of the Gulf Stream. The ship herself was in a clear area, while around the horizon lay fog banks, their upper surfaces being clearly defined against the western sky. At frequent intervals wisps, streamers, columns, and often larger masses of fog rose above the general level top of the fog banks. Several of these rising portions resembled waterspouts, and might easily have been mistaken for them. Others, more massive, looked like distant mountainous islands. Others again might readily have been recorded as icebergs. Careful observations from the bridge, both with the naked eye and with marine glasses, showed a slow spiralling or vortex motion in some of the smaller and more slender forms of these fog growths. It appeared as if this phenomenon were due to a convectional ascent induced by the vertical temperature gradient between the lower air, lying on the warm water, and the colder air at the top of the fog banks, cooled by radiation at sunset. An eddying motion might easily be produced under such conditions. The surface wind at the time was very gentle, and the lower clouds gave no indication of a rapid movement of the air a short distance aloft. Hence there seemed little opportunity for a rolling-over and intermingling of surface and upper air currents.

The only marked atmospheric disturbance occurred during about 36 hours while the *Tampa* was running across the Bank toward and from Cape Race. Pressures fell from 30 inches to 29.15 inches in 18 hours (barograph readings). Fresh NE. gales, reaching a force of 10 Beaufort, blew for several hours, with a very rough sea and some rain squalls. The clinometer in the engine room showed a maximum roll of 46°. As the *Tampa* was making slow progress against the gale and heavy sea, and had suffered damage to one of her boats, she was put about and headed south, before the wind. With a rising barometer, the wind backed to the NW., with slowly diminishing force and a clearing sky. A radio report from Cape Race reported a wind velocity of 63 miles an hour at that station. This was undoubtedly exceeded on the *Tampa*. The weather broadcast from Arlington noted "a disturbance of considerable intensity central immediately south of Newfoundland moving slowly northeastward." Confirmatory evidence of this fact was found in reports received on the *Tampa* from other vessels in the general vicinity but farther south, as well as in the observations made on the *Tampa* herself, which apparently passed nearly through the center of the disturbance, and somewhat to the north of it. The rear of the cloud sheet was clearly seen retreating to the eastward on the following day.

The highest pressures (30.45 inches) occurred during a well-marked anticyclone which prevailed throughout the last few days of the *Tampa's* Ice Patrol duty. A report of an iceberg not far from the steamer lanes, south of the tail of the Bank, had led to a quick run to the southward. For three or four days the vessel "drifted" most of the time, lying a little north of the steamer lanes near the northern edge of the Gulf Stream, in a dense fog, with a very smooth sea, variable breezes, mostly southerly and southwesterly, and calms; temperatures running between 60° and 70°. These were "typical" conditions for fog. No search for ice was possible during this spell.

Although, as stated above, the patrol ship spends most of her time in the cold water, she occasionally runs across the so-called "Cold wall" into the Gulf Stream. The contrast between the cold greenish Arctic water and the warm bluish Gulf Stream water is sometimes very clearly seen, as was the case on the return voyage of the *Tampa* to Halifax early in July, 1923. On one occasion, in 1922, when the ship was placed directly across the "Cold wall," the water temperature at the bow was 34°, and at the stern 56°. On a fine day in June, 1922, swimming liberty was granted to all hands. The men dove off the ship into water at a temperature of 70°, while within a half mile to the northward there was an iceberg.

Daily weather maps based on radio reports.—Through the generous cooperation of Chief Radio Man Reynolds of the *Tampa* it was possible to construct synoptic weather maps for the eastern United States based on the regular Weather Bureau observations broadcast from Arlington. With a few exceptions, a map was drawn every morning on the basis of the 8 p. m. (75th meridian time) observations, and on most days a second map, based on the 8 a. m. observations, was also constructed. In addition to the land stations regularly included in the broadcast, reports from vessels at sea received by the *Tampa*, as well as the observation made on the *Tampa*, were also used in preparing these maps. The construction and study of the maps proved most interesting, not only from the point of view of the weather conditions prevailing at home, but also because of their use in making general forecasts for the western North Atlantic. Such forecasts were made daily on board by the writer, and were not without interest and value. The development and the later break-up over the eastern United States of the hot wave of the third week of June was carefully watched on these daily maps constructed at sea. The Associated Press broadcasts received on the *Tampa* reported, as was expected, many deaths from sunstroke and thousands of heat prostrations within the hot-wave area. At sea during these same days the temperatures were between 40° and 50°, heavy clothing was being worn, and steam heat was turned on in the cabins. The passage eastward down the St. Lawrence Valley, or farther to the south, of several depressions was also watched with interest with reference to their possible control over the weather at sea. With one exception, however, these June cyclonic areas were too weak, and passed too far to the northward, to cause any appreciable disturbance over the area of the *Tampa's* cruising. Conditions in the eastern United States favorable for heat and for wind-shift line thunderstorms were readily picked out, even on the incomplete maps constructed on shipboard

With regard to the use, in the construction of daily weather maps at sea, of meteorological observations

received from other vessels, the writer's own experience leads to his making the following suggestions. Under the present plan, all vessels in the danger zone are expected to report to the Ice Patrol ship regularly every four hours their position, course, speed, and water surface temperatures. These reports vary greatly in their completeness and accuracy. There is diversity as to the hours of observation and often extreme uncertainty as to what time is used, whether G. M. T. (Greenwich mean time), or ship's local time, or 75th meridian time. Some vessels report barometer reading, wind direction and force, weather, state of sea, etc., while others do not. Further, a study of the barometer readings reported to the *Tampa* showed beyond question that these were often considerably in error, and therefore not comparable, or of value in drawing a synoptic map. These difficulties in the pressure readings probably result from (1) instrumental errors, (2) differences in elevation above sea level (3) carelessness in observation, and (4) other causes. If it is desirable that regular daily weather maps should be properly constructed on board the Ice Patrol ships, and that such maps should become of real use in forecasting at sea, it is suggested that definite arrangements be made with the regular passenger lines whereby two of the usual four-hourly observations now requested should always be made at 8 a. m. and 8 p. m., 75th meridian time (G. M. T., 1 a. m. and p. m.), in order that they may synchronize with the Weather Bureau broadcasts; that the ship's barometers should frequently be compared with a standard, and the corrections determined; and that greater care should be taken in making all the observations. The complete record, to be sent to the Ice Patrol ship at 8 a. m. and 8 p. m. (75th meridian time) in systematic and regular order, would be as follows: Name (letters) of vessels; time (G. M. T., given in a four-figured group of numerals, starting with 0000 at midnight); latitude; longitude; course; speed; surface water temperature; air temperature; barometer (reduced to sea level); wind direction and force; fog (yes or no); remarks. This same scheme might naturally well be followed in sending the regular four-hourly reports already asked for by the Ice Patrol.

Icebergs seen during the cruise.—Although the June cruise of the *Tampa* came just at the end of the 1923 ice season, several icebergs dangerous to navigation were seen at very close quarters. Two of them were of a common type; low, elongated and well water-worn masses, without pinnacles or vertical sides, and of a general "saddleback" form. One had two distinct "streaks" of dirt in it, and showed a well-marked fissure extending from top to bottom, filled with a more bluish ice than that of the berg itself. The second, with many distinct water-worn gullies on its surface, showed a former sea-level erosion line tilted up at an angle of nearly 90°, indicating that the berg had lately shifted its position by that amount. A rough calculation gave a weight of about 30,000 tons to the larger of these two bergs. The other bergs were of the pinnacled type. A small one had a height of about 75 feet and a length of 200 feet and had apparently lately split through, as one end presented a sheer vertical face from top to bottom. This berg could be seen long after the *Tampa* had left it, far away on the horizon, reddened by the rays of the setting sun. The largest berg was 170 feet high from the ocean surface to its topmost pinnacle, as determined by angular measurements from the bridge. From its highest peak it sloped symmetrically toward its lowest point. On one side there was a sheer vertical face from top to bottom. This last berg was by far the largest, most majestic and most impressive which was seen. All the bergs had numbers of small "growlers" drifting near them.

General impressions of the cruise.—Many incidents come to mind as the writer recalls his cruise of 15 days on the Ice Patrol: the first iceberg seen on a cold grey day before sunrise, sullen, massive, forbidding; the numerous drills of the men; the fresh cod caught while the vessel was at anchor on the Bank; the friendly conversations carried on by radio with the Cape Race and the St. Pierre operators craving human contact and sympathy at their lonely posts of duty; the urgent call for medical aid for a new-born baby on Sable Island, the "graveyard of the Atlantic," which came when the *Tampa* was over 200 miles away, drifting in a dense fog in the probable vicinity of ice; her immediate start for Sable Island, through the fog, on her errand of mercy; the relief experienced by all hands when a later message reported the baby better and no longer in need of help; the Fourth of July National salute at sea in a thick fog, on the westward course back to Halifax. But the outstanding thought is the splendid work which is being done, year after year, quietly and unostentatiously, amid the dangers of ice and storm, by the faithful officers and men of the United States Coast Guard on Ice Patrol.[4]

[4] Fuller details concerning the work of the Ice Patrol and the movements of the ice may be found in the following: Edward H. Smith (lieutenant, United States Coast Guard), "Some meteorological aspects of the ice patrol work in the North Atlantic," MONTH. WEA. REV., December, 1922, pp. 629-631, and "Practical knowledge regarding iceberg drifts for trans-Atlantic navigators," *Pilot Chart of the North Atlantic Ocean*, March, 1923, U. S. Hydrographic Office. The writer acknowledges his indebtedness to Lieutenant Smith's articles, from which many of the facts here given were obtained, and from which two charts (figs. 1 and 2) were taken.